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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands	)	CC Docket No. 92-166

COMMENTS OF THE FEDERAL AVIATION ADMINISTRATION ON THE NOTICE OF PROPOSED RULEMAKING

Background

The Federal Communications Commission (FCC) is considering several proposals to construct satellite systems that would provide voice and data mobile satellite services (MSS) in the 1610-1626.5/2483.5-2500 MHz frequency bands. In February 1992, a co-primary international allocation for MSS was made at the World Administrative Radio Conference (WARC-92). The 1610-1626.5 MHz band was allocated on a primary basis for MSS Earth-to-space operations (subject to FN 731E an FN 731F) and the 2483.5 - 2500 MHz band was allocated for MSS space-to-Earth operations. On January 6, 1993 the initial meeting a Negotiated Rulemaking (NRM) Committee was held. It's function was to provide the FCC with expert advice and recommendations on technical and operational matters related to establishing a mobile satellite service in the 1.6/2.4 GHz bands. The Federal Aviation Administration (FAA) was represented as one of the 16 members of the Committee. The FAA interest was limited to the protection of Aeronautical Services, both existing and planned which might be compromised by the operation of this new service.

The FAA actively participated in NRM drafting groups responsible for major portions of the NRM final report. That report contains the best information on the protection of the aeronautical radionavigation service (ARNS) as of that time. The FCC indicated that the NRM proposals form the basis for the rules proposed in this Notice. After reviewing the Notice, the FAA finds that it must make the following comments in light of events which have taken place since the drafting of that report.

Feeder Links

In the matter of feeder links, the Commission correctly reiterated the FAA position with respect to the 5150-5250 MHz band[1]. The FAA plans for this band have not lessened since the NRM and we maintain our opposition to the use of this band for MSS feeder links due to

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the high potential for interference to aeronautical services being planned for that band.

Licensing of Mobile Earth Stations (MESs) and Ground Earth Stations (GESs)

The FAA supports the licensing of MESs and GESs by the FCC[2] . Only through the regulatory process can the aviation community have some assurance that emission limits will be placed on MSS terminals which are adequate to protect aeronautical safety communications and ARNS.

Of primary importance to the aeronautical community in general and to the FAA in particular is the protection of the ARNS Systems "Global Positioning System" (GPS) and "Global Orbital Navigation Satellite System" (GLONASS).

In-band Power Density Limit

The Commission indicated that the use of the 1610-1616 MHz band by MSS is premised upon moving GLONASS below 1610 MHz[3]. During the NRM, the MSS proponents stated that they could not provide MSS service at the Effective Isotropic Radiated Power (EIRP) emission limits necessary to protect foreseen GLONASS operations[4] if GLONASS and MSS had to share the same frequency band. The FAA stressed that the power density limit specified in RR 731F, -15 dB(W/4kHz), is far too high to protect inband GLONASS for anything but, possibly, some high altitude enroute navigation scenarios in Russia.

Shift in GLONASS Frequency Band of Operation.

The Russian Federation has indicated their willingness to shift GLONASS out of the 1610-1616 MHz band in order to protect the Radio Astronomy Service, as part of a three phase process. This will require a complete shift to the so-called antipodal operation. They already have begun this shift with two of their satellites. According to the Russian Federation, they hope to achieve complete antipodal operation by the turn of the century (1998). We support the need for a transition plan[5] in order to protect GLONASS until the Russian Federation can, in fact, accomplish the shift to full antipodal operation. The FAA would be willing to participate in developing such a plan. It must be remembered that the current GLONASS satellite design will not support a complete shift to antipodal operation. The newer GLONASS-M satellite will be required. According to the Russian Federation, a significant number of existing GLONASS satellites are already built which must be launched prior to full scale launch of the GLONASS-M constellation. While the FAA supports the shift to antipodal operation, it realizes that it may take some time due to the expense of replacing a large segment of its in-orbit satellites with the new GLONASS-M satellite. It is during this time that a transition plan must provide protection for all GLONASS operations.

Averaging Period

The averaging period of 20 msec is important for measuring the MSS signal level[6]. It should not be construed as having any meaning with respect to GPS or GLONASS operational time constants or exposure time.

Band Limits for GPS and GLONASS Protection.

The use of GPS for aviation is undergoing intense research and development. Evolving techniques for the required accuracy for precision approach guidance require a wider GPS bandwidth. In order to protect the eventual system implementation, as a minimum, a band of +/- 10 MHz about the GPS center frequency must be protected from interference from external sources, including MSS out-of-band (OOB) emissions. Thus the FAA recommends that the protection bandwidth for GPS be established at least 20 MHz wide, i.e., 1575.42 +/- 10MHz.

With respect to GLONASS, the protection band is 1598 - 1610 MHz. This band encompasses GLONASS antipodal operation and downward shifts in frequency of up to 6 channels.

MSS Emission Limits Within the Protection Bands.

Table 1 gives the link analysis for the GPS and GLONASS interference thresholds.

Table 1

GPS and GLONASS Interference Threshold at the Receiver Antenna Port		
	GPS	GLONASS
Minimum Navigation Signal Level at Antenna dBW	-160	-161
I/C for Broadband noise, dB	24	22
Antenna Gain, dB	-4.5	-4.5
Cable loss, dB	-1.5	-1.5
Interference Threshold at Receiver, dBW/1 MHz	-142	-145

Table 2 is a link analysis of MSS emission limits to protect GPS and GLONASS to the levels in table 1. That analysis shows that the maximum mobile earth terminal (MET) OOB EIRP in the GPS band is -68 dBW/1MHz and in the GLONASS band is -71 dBW/1MHz. It is recommended that OOB levels be measured in a 4 kHz bandwidth and limits established at -92 dBW/4kHz and -95 dBW/4kHz respectively to assure that there are not large spurs of narrow bandwidth.

It should be noted that this analysis assumes an MSS-to-aircraft separation of 100 feet, as in the NRM report[7]. This distance separation has subsequently been reviewed by the aviation community. It has been accepted as a reasonable minimum separation for most scenarios. However, it does not cover one particularly important scenario; that of an aircraft on final approach passing over an MSS terminal at ground level under the approach path. Aircraft to MSS separations as close as 200 feet or less are possible under these situations. This encounter would, of course, be transient in nature. The impact of this transient encounter on GPS and GLONASS receiver operation is not known. The Department of Defense in coordination with the FAA is currently involved in a test program which should give some insight into the impact on GPS. As GLONASS receivers are made available, tests will be planned for them as well.

Table 2

MET Maximum EIRP to Protect GPS and GLONASS at 100'		
	GPS	GLONASS
Threshold/4kHz (at receiver)	-142	-145
Cable loss	-(-1.5)	-(-1.5)
Maximum GLONASS antenna @ -85 degrees	-(-4.5)	-(-4.5)
Path Loss (Lp) @ 100'	-(-76)	-(-76)
Extra Margin of Protection for Safety Service	-3	-3
Multiple sources and unknown factors	-5	-5
Maximum MET EIRP*, dBW/1MHz	-68	-71

* This limit applies to MET MSS out-of-band emissions within the ARNS protection band. See text.

(1) Notice of Proposed Rulemaking, CC Docket No. 92-166 (NPRM), paragraph 75.
(2) NPRM, paragraph 88.
(3) NPRM, paragraph 14.
(4) During aircraft approach, landing and taxiing.
(5) NPRM in footnote 59.
(6) NPRM, Appendix A, paragraph 15(b)
(7) NRM Final Report, paragraph 3.3.4.2.

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